

**What Is Claimed Is:**

1           1.       A method for manipulating a window within a three-dimensional  
2 (3D) display model, comprising:  
3           receiving an input from a 2D pointing device, wherein the input specifies a  
4 2D offset within a 2D display, wherein the 2D display provides a view into the 3D  
5 display model;  
6           using the 2D offset to move a cursor to a position in the 2D display;  
7           determining if the cursor overlaps a window within the 3D display model;  
8 and  
9           if the cursor overlaps a window,  
10                   determining a 2D position of the cursor with respect to a  
11                   2D coordinate system for the window, and  
12                   communicating the 2D position to an application associated  
13                   with the window to enable a user of the 2D pointing device to  
14                   interact with the application.

1           2.       The method of claim 1, wherein determining if the cursor overlaps  
2 a window within the 3D display model involves:  
3           projecting a ray from a predefined viewpoint in the 3D display model  
4 through the cursor, which is located in a rectangle representing the 2D display in  
5 the 3D display model, toward one or more windows in the 3D display model; and  
6           determining if the ray intersects a window.

1           3.       The method of claim 2, wherein determining the 2D position of the  
2 cursor with respect to the 2D coordinate system of the window involves:

3           determining a 3D position where the ray intersects the window within the  
4 3D display model; and  
5           transforming the 3D position in the 3D display model into a 2D position  
6 with respect to the 2D coordinate system for the window based upon the size,  
7 position and orientation of the window within the 3D display model.

1           4.     The method of claim 3, wherein the size, position and orientation  
2 of the window within the 3D display model are specified by a number of attributes  
3 of the window, including:  
4           a height;  
5           a width;  
6           an x-position;  
7           a y-position;  
8           a z- position;  
9           a first rotation around a vertical axis of the window; and  
10          a second rotation around a horizontal axis of the window.

1           5.     The method of claim 1, further comprising:  
2           receiving a second input from the 2D pointing device; and  
3           in response to the second input, changing a viewing angle for the 3D  
4 display model by rotating objects within the 3D display model around a  
5 predefined viewpoint.

1           6.     The method of claim 1, wherein if the cursor overlaps a given  
2 window, the given window becomes a selected window and appears opaque while  
3 other windows within the 3D display model appear translucent.

1           7.       The method of claim 1, wherein if a command is received to  
2 minimize a window, the window minimization operation is illustrated as an  
3 animation that moves the window toward a minimized position near a border of  
4 the 2D display while reducing the size of the window to its minimized size.

1           8.       The method of claim 1, wherein if a command is received to close  
2 a window, the window closing operation is illustrated as an animation that throws  
3 the window away by moving the window toward the background of the 3D  
4 display model and causing the window to fade away.

1           9.       The method of claim 1, wherein if a command is received to rotate  
2 all windows in the 3D display model, the method further comprises rotating all  
3 windows in the 3D display model, so that windows are viewed from an oblique  
4 angle through the 2D display, whereby the contents of the windows remain  
5 visible, while the windows occupy less space in the 2D display and are less likely  
6 to overlap each other.

1           10.      The method of claim 9, wherein when a window is rotated, a spine  
2 located on a side edge of the window becomes visible, wherein the spine contains  
3 identification information for the window.

1           11.      The method of claim 9, wherein when a user selects one of the  
2 rotated windows, the method further comprises:  
3           moving the selected window in front of the other windows;  
4           unrotating the selected window so it faces the user; and  
5           moving the other windows back to their original positions and  
6 orientations.

1           12.     The method of claim 1, wherein the 2D pointing device can  
2 include:  
3           a mouse;  
4           a track ball;  
5           a joystick; and  
6           a glide point.

1           13.     A computer-readable storage medium storing instructions that  
2 when executed by a computer cause the computer to perform a method for  
3 manipulating a two-dimensional (2D) window within a three-dimensional (3D)  
4 display model, the method comprising:  
5           receiving an input from a 2D pointing device, wherein the input specifies a  
6 2D offset within a 2D display, wherein the 2D display provides a view into the 3D  
7 display model;  
8           using the 2D offset to move a cursor to a position in the 2D display;  
9           determining if the cursor overlaps a window within the 3D display model;  
10          and  
11           if the cursor overlaps a window,  
12                   determining a 2D position of the cursor with respect to a  
13                   2D coordinate system for the window, and  
14                   communicating the 2D position to an application associated  
15                   with the window to enable a user of the 2D pointing device to  
16                   interact with the application.

1           14.    The computer-readable storage medium of claim 13, wherein  
2   determining if the cursor overlaps a window within the 3D display model  
3   involves:  
4           projecting a ray from a predefined viewpoint in the 3D display model  
5   through the cursor, which is located in a rectangle representing the 2D display in  
6   the 3D display model, toward one or more windows in the 3D display model; and  
7           determining if the ray intersects a window.

1           15.    The computer-readable storage medium of claim 14, wherein  
2   determining the 2D position of the cursor with respect to the 2D coordinate  
3   system of the window involves:  
4           determining a 3D position where the ray intersects the window within the  
5   3D display model; and  
6           transforming the 3D position in the 3D display model into a 2D position  
7   with respect to the 2D coordinate system for the window based upon the size,  
8   position and orientation of the window within the 3D display model.

1           16.    The computer-readable storage medium of claim 15, wherein the  
2   size, position and orientation of the window within the 3D display model are  
3   specified by a number of attributes of the window, including:  
4           a height;  
5           a width;  
6           an x-position;  
7           a y-position;  
8           a z- position;  
9           a first rotation around a vertical axis of the window; and  
10          a second rotation around a horizontal axis of the window.

1           17.    The computer-readable storage medium of claim 13, wherein the  
2 method further comprises:  
3           receiving a second input from the 2D pointing device; and  
4           in response to the second input, changing a viewing angle for the 3D  
5 display model by rotating objects within the 3D display model around a  
6 predefined viewpoint.

1           18.    The computer-readable storage medium of claim 13, wherein if the  
2 cursor overlaps a given window, the given window becomes a selected window  
3 and appears opaque while other windows within the 3D display model appear  
4 translucent.

1           19.    The computer-readable storage medium of claim 13, wherein if a  
2 command is received to minimize a window, the window minimization operation  
3 is illustrated as an animation that moves the window toward a minimized position  
4 near a border of the 2D display while reducing the size of the window to its  
5 minimized size.

1           20.    The computer-readable storage medium of claim 13, wherein if a  
2 command is received to close a window, the window closing operation is  
3 illustrated as an animation that throws the window away by moving the window  
4 toward the background of the 3D display model and causing the window to fade  
5 away.

1           21.    The computer-readable storage medium of claim 13, wherein if a  
2 command is received to rotate all windows in the 3D display model, the method

3 further comprises rotating all windows in the 3D display model, so that windows  
4 are viewed from an oblique angle, whereby the contents of the windows remain  
5 visible, while the windows occupy less space in the 2D display and are less likely  
6 to overlap each other.

1 22. The computer-readable storage medium of claim 21, wherein when  
2 a window is rotated, a spine located on a side edge of the window becomes  
3 visible, wherein the spine contains identification information for the window.

1 23. The computer-readable storage medium of claim 21, wherein when  
2 a user selects one of the rotated windows, the method further comprises:  
3 moving the selected window in front of the other windows;  
4 unrotating the selected window so it faces the user; and  
5 moving the other windows back to their original positions and  
6 orientations.

1 24. The computer-readable storage medium of claim 13, wherein the  
2 2D pointing device can include:  
3 a mouse;  
4 a track ball;  
5 a joystick; and  
6 a glide point.

1 25. An apparatus that manipulates a two-dimensional (2D) window  
2 within a three-dimensional (3D) display model, comprising:

3           an input mechanism configured to receive an input from a 2D pointing  
4 device, wherein the input specifies a 2D offset within a 2D display, wherein the  
5 2D display provides a view into the 3D display model;  
6           a cursor mechanism configured to use the 2D offset to move a cursor to a  
7 position in the 2D display; and  
8           a window manipulation mechanism configured to determine if the cursor  
9 overlaps a window within the 3D display model;  
10          wherein if the cursor overlaps a window, the window manipulation  
11 mechanism is configured to,  
12                  determine a 2D position of the cursor with respect to a 2D  
13                  coordinate system for the window, and to  
14                  communicate the 2D position to an application associated  
15                  with the window to enable a user of the 2D pointing device to  
16                  interact with the application.

1           26.    The apparatus of claim 25, wherein while determining if the cursor  
2 overlaps a window within the 3D display model, the window manipulation  
3 mechanism is configured to:  
4                  project a ray from a predefined viewpoint in the 3D display model through  
5 the cursor, which is located in a rectangle representing the 2D display in the 3D  
6 display model, toward one or more windows in the 3D display model; and to  
7                  determine if the ray intersects a window.

1           27.    The apparatus of claim 26, wherein while determining the 2D  
2 position of the cursor with respect to the 2D coordinate system of the window, the  
3 window manipulation mechanism is configured to:



4           determine a 3D position where the ray intersects the window within the 3D  
5 display model; and to  
6           transform the 3D position in the 3D display model into a 2D position with  
7 respect to the 2D coordinate system for the window based upon the size, position  
8 and orientation of the window within the 3D display model.

1           28.    The apparatus of claim 27, wherein the size, position and  
2 orientation of the window within the 3D display model are specified by a number  
3 of attributes of the window, including:

4           a height;  
5           a width;  
6           an x-position;  
7           a y-position;  
8           a z- position;  
9           a first rotation around a vertical axis of the window; and  
10          a second rotation around a horizontal axis of the window.

1           29.    The apparatus of claim 25, further comprising a viewing angle  
2 changing mechanism configured to:

3           receive a second input from the 2D pointing device; and  
4           in response to the second input, to change a viewing angle for the 3D  
5 display model by rotating objects within the 3D display model around a  
6 predefined viewpoint.

1           30.    The apparatus of claim 25, wherein if the cursor overlaps a given  
2 window, the window manipulation mechanism is configured to make the given a

3 selected window that appears opaque while other windows within the 3D display  
4 model appear translucent.

1 31. The apparatus of claim 25, wherein if a command is received to  
2 minimize a window, the window manipulation mechanism is configured to  
3 illustrate the minimization operation as an animation that moves the window  
4 toward a minimized position near a border of the 2D display while reducing the  
5 size of the window to its minimized size.

1 32. The apparatus of claim 25, wherein if a command is received to  
2 close a window, the window manipulation mechanism is configured to illustrate  
3 the window closing operation as an animation that throws the window away by  
4 moving the window toward the background of the 3D display model and causing  
5 the window to fade away.

1 33. The apparatus of claim 25, wherein if a command is received to  
2 rotate all windows in the 3D display model, the window manipulation mechanism  
3 is configured to rotate all windows in the 3D display model, so that windows are  
4 viewed from an oblique angle through the 2D display, whereby the contents of the  
5 windows remain visible, while the windows occupy less space in the 2D display  
6 and are less likely to overlap each other.

1 34. The apparatus of claim 33, wherein when a window is rotated, a  
2 spine located on a side edge of the window becomes visible, wherein the spine  
3 contains identification information for the window.

1           35.     The apparatus of claim 33, wherein when a user selects one of the  
2 rotated windows, the window manipulation mechanism is configured to:  
3           move the selected window in front of the other windows;  
4           unrotate the selected window so it faces the user; and to  
5           move the other windows back to their original positions and orientations.

1           36.     The apparatus of claim 25, wherein the 2D pointing device can  
2 include:  
3           a mouse;  
4           a track ball;  
5           a joystick; and  
6           a glide point.

1           37.     A means for manipulating a two-dimensional (2D) window within  
2 a three-dimensional (3D) display model, comprising:  
3           an input means for receiving an input from a 2D pointing device, wherein  
4 the input specifies a 2D offset within a 2D display, wherein the 2D display  
5 provides a view into the 3D display model;  
6           a cursor means configured to use the 2D offset to move a cursor to a  
7 position in the 2D display; and  
8           a window manipulation means configured to determine if the cursor  
9 overlaps a window within the 3D display model;  
10          wherein if the cursor overlaps a window, the window manipulation means  
11 is configured to,  
12                   determine a 2D position of the cursor with respect to a 2D  
13                   coordinate system for the window, and to

14                   communicate the 2D position to an application associated  
15                   with the window to enable a user of the 2D pointing device to  
16                   interact with the application.